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ORIGINAL ARTICLE

# Factor structure and psychometric properties of the Spanish version of the Body Image Avoidance Questionnaire (BIAQ)

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## Abstract

**Purpose** The main objective of this study was to analyse the factor structure and psychometric properties of a Spanish validation of the Body Image Avoidance Questionnaire (BIAQ) in a community sample of adolescents.

**Methods** A total of 4283 people (55.9% girls, aged 12–18) participated.

**Results** Confirmatory factor analysis corroborated four first-order factors related to a second-order factor including the total BIAQ score, with excellent fit and invariance across sex. The total internal consistency of the questionnaire was adequate, although two factors showed low reliability. Strong relationships were found with scales evaluating preoccupation with weight and dysmorphic concerns, and moderate correlations with dissatisfaction and investment in appearance. It was found that 24.06% of adolescents with body image disturbance could be at risk of developing a body image disorder.

**Conclusions** The results of this study support the use of the Spanish translation of the BIAQ for assessing behavioural characteristic of body image disturbance.

**Level of evidence** V, cross-sectional descriptive study.

**Keywords** Body image disturbance · Adolescents · Validity · Body image avoidance · BIAQ · Psychometric properties

## Introduction

Sociocultural pressures to achieve the ideal of beauty favour internalizing and overvaluing appearance, making adolescence a period of vulnerability for developing dissatisfaction with body image [1]. Dissatisfaction with body image has been related to low self-esteem, higher risk of depression [2], poorer quality of life [3], anxiety [4] risk of symptomatic characteristics for diagnosis of eating disorders (EDs) [5, 6], as well as major characteristics of body dysmorphic disorder (including muscle dysmorphia) [7]. However, this dissatisfaction is not in itself indicative, at least not independently or exclusively, of body image disorder (BID) [8]. The emotional and behavioural consequences of such dissatisfaction must also be considered [9].

In spite of the demonstrated importance of altered behaviour in the development and maintenance of BID [10], less attention has been given to its evaluation, at least in non-clinical populations. The behavioural component may lead to avoidance and/or checking of body, weight, shape, size or general appearance. Avoidance refers to not confronting one's own body or to not engaging in situations that generate preoccupation with appearance, such as those in which the person believes that he or she will be evaluated (e.g., not looking in the mirror or at reflective surfaces, camouflaging parts of the body, avoiding social situations). Body checking includes repetitive behaviour evaluating shape, size or weight (e.g., weighing oneself repeatedly, looking in the mirror often). Both avoidance and checking have been strongly related to body image dissatisfaction, preoccupation with weight, shape, appearance and eating in community

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samples, in which clinical indicators are stable; these behaviours may interfere more in populations with EDs and body dysmorphic disorder (BDD) [11, 12]. Such behaviours have been studied to a greater extent in EDs, but they are also characteristic of BDD, where preoccupation is not related to fat or body weight but to one or more defects that may be minor to the observer but are clearly perceived by the one whose physical appearance is being evaluated [11, 13, 14]. High comorbidity between EDs and BDD [15] has led some authors to consider both disorders as a BID [7], in which body image dissatisfaction may lead to body image distortion [16].

These avoidance behaviours and/or checking of body, weight, shape, size or general appearance could be considered obsessive–compulsive features, which would fit in with possible inclusion of EDs or BDD in the obsessive–compulsive spectrum [17], although not necessarily in the diagnosis of obsessive-compulsive disorder [18]. Examples of obsessive and compulsive behaviour beliefs that increase risk for EDs in nonclinical populations are physical exercise to regulate negative affect [19], body checking cognitions and behaviours, related safety and control behaviours, and binging, purging and exercise behaviours [20]. This type of repetitive checking, as with weight, is also observed in clinical populations [21], in which perfectionism and neuroticism moderate the relationship between body dissatisfaction and obsessive–compulsive symptoms [22].

There are few instruments for evaluating the altered behaviour typical of BID. The Body Image Avoidance Questionnaire (BIAQ) [23] is the one most widely used for evaluating behaviours like avoiding looking at one's own body or allowing others to see one's body [24]. The BIAQ has been translated and validated in Italian [25], German [26, 27], French [28], Portuguese [29] and Polish [30]. However, it has not yet been validated in Spanish. The known validations of the BIAQ have been performed with adults and adolescents with no psychopathology and subjects with eating or obesity psychopathology, where its discrimination between populations mainly with EDs has been demonstrated [23, 26, 27, 30]. Its high sensitivity for detecting change during therapeutic intervention in patients with bulimia nervosa has also been demonstrated [23].

Some studies have validated the questionnaire only with girls and others with both sexes. As far as we know, only the French validation has contributed data on the invariance of measurement across sex, which showed that the majority of the items on the BIAQ are comparable between boys and girls. All of the studies have been characterized by having generally demonstrated adequate internal consistency indicators and evidence of validity. It has been strongly related to measures assessing dissatisfaction with BI, attitude towards BI and eating disorder behaviours [27, 28, 30]. However, it seems that there is no consensus on the number of factors in the instrument or their coincidence with those found by the designers of the instrument. Rosen et al. [23] found four factors, namely, "clothing", "social activities", "eating restraint" and "grooming and weighing". The factors found in validations in other languages have varied from 2 to 4 first-order factors, and some studies have demonstrated an overall second-order factor [26, 28, 30, 31]. The Portuguese validation, which was based on an experts' theoretical model, was validated using confirmatory factor analysis with satisfactory results. Some studies have eliminated items from the questionnaire, while others have retained all 19 of its original items.

With 472 million native Spanish speakers worldwide [32] and no specific validated measure in Spanish for evaluating body image avoidance to date, we believe a Spanish adaptation and validation of the BIAQ to be necessary. Therefore, in this study, we posed the following objectives: (1) adapt the BIAQ questionnaire to Spanish, (2) study the BIAQ questionnaire's factor structure, (3) analyse BIAQ's invariance of measurement across sex, (4) determine the BIAQ's reliability and evidence of validity, and (5) study its measurement sensitivity and specificity to set a cutoff point.

## Method

### Participants and procedure

The sample consisted of 4283 subjects aged 12–18 ($M = 14.66$; SD = 1.67) from 32 public and private high schools in western Andalusia (Spain). Girls accounted for 55.9% of the sample. The average social class index (SCI) per Hollingshead [33] was 53.03 (SD = 21.33) (mean social class).

Participants were recruited by incidental sampling. Several high schools were contacted, and the objectives of the study were presented to the principals. Assessments were made in groups in the classrooms at each high school during school hours by psychologists who were experts in psychological evaluation.

### Instruments

#### First self-administered assessment (by authors)

This assessment was used to identify participant sex and age and average Hollingshead [33] Social Class Index (SCI).

#### Body Image Avoidance Questionnaire BIAQ [23]

This scale is comprised of 19 items that evaluate avoidance behaviour caused by dissatisfaction with one's physical appearance. It has a Likert-type response format with

six choices from 0 = "never" to 5 = "always". All item responses are positively keyed. The authors of the questionnaire identified four factors: clothing, which refers to using clothing to conceal or avoid body exposure (e.g., "I don't wear 'revealing' clothes (e.g., bathing suits, tank tops, or shorts)"; social activities, which refers to avoiding social activities involving eating in front of other people or situations where weight and physical appearance could be the subject of attention (e.g., "I do not go out socially if the people I am with are thinner than me"); eating restraint, whose items assess food restriction or dieting (e.g., "I restrict the amount of food I eat); and grooming and weighing, which evaluates personal care habits involving dressing well, weighing or grooming (e.g., "I weigh myself"). A total score may be found by adding up the items. The authors found an internal consistency of $\alpha = 0.89$, test–retest reliability (at 2 weeks) of $\alpha = 0.87$ and high correlations with scales evaluating negative attitudes towards weight, shape and distorted perception of body size.

Translation and adaptation of the BIAQ questionnaire to Spanish was performed by two translators, one of them familiar with the Spanish culture and the other familiar with the culture of the United States. First, it was translated to Spanish and then this translation was backtranslated into English. These versions were then compared with the original English version by two clinicians who were experts on the questionnaire.

### Dysmorphic Concern Questionnaire DCQ [34]

Spanish version, by Senín-Calderón et al. [35]. This examines concerns with body or body parts typical of BDD. It is comprised of seven items with a four-choice Likert response, in which each item is rated 0–3, where 3 shows the most concern. All item responses are positively keyed. The authors of the instrument found internal consistencies of $\alpha = 0.80$ to $\alpha = 0.88$. With an adult Spanish population, the DCQ showed internal consistency of $\alpha = 0.85$ and test–retest reliability of $r = 0.87$ (average interval of one month). For this sample, the Cronbach's $\alpha = 0.81$.

### Children's depression inventory (CDI) [36]

This inventory was adapted to Spanish by Del Barrio and Carrasco [37]. The CDI evaluates the presence and severity of depressive symptomatology in children and adolescents. It contains 27 items with three answer choices (0 = symptom absent, 1 = moderate symptom, and 2 = severe symptom). Responses to Items 1, 3, 4, 6, 9, 12, 14, 17, 19, 20, 22, 23, 26, 27 are positively keyed, and the rest are reverse-scored. The Spanish version has an internal consistency of $\alpha = 0.70$ to $\alpha = 0.94$ and adequate test–retest reliability (at an interval of 2–4 weeks). The Cronbach's α found with the sample in this study was $\alpha = 0.85$ for the total test.

### Multidimensional Body-Self Relations Questionnaire-Appearance Scale (MBSRQ-AS) [38]

Spanish version by Roncero et al. [39]. This measure consists of 34 items that assess attitudes (evaluative, cognitive and behavioural) towards body image. The version used for the study has five factors: appearance evaluation (AE), appearance orientation (AO), body areas satisfaction (BAS), overweight preoccupation (OP), and self-classified weight (a factor not used in this study). The items are answered on a 5-point Likert-type scale and assess agreement from 1 (strongly disagree) to 5 (strongly agree), frequency from 1 (never) to 5 (quite often), or satisfaction from 1 (very dissatisfied) to 5 (very satisfied). For the items related to weight, the participants use ratings from 1 (very underweight) to 5 (very overweight). Items 11, 14, 16, 18, 19, 20 are reverse scored, with the rest being positively keyed. This instrument was administered to $n = 640$ participants. The Spanish version of the MBSRQ-AS showed favourable internal consistency indicators (0.76–0.88). With the sample in this study, internal consistency for the AO factor was Cronbach's $\alpha = 0.90$, for AE $\alpha = 0.87$, for BAS $\alpha = 0.86$, and for OP $\alpha = 0.67$.

### Data analyses

Descriptive analyses were performed for the items on the BIAQ questionnaire. The sample was divided at random into two groups for cross-validation. Exploratory factor analysis (EFA) was used with Sample 1 to find evidence of construct validity, and the structure found was subjected to confirmatory factor analysis (CFA) with Sample 2. The model fit was evaluated with the following goodness-of-fit criteria: Satorra–Bentler Chi square ($X^2$), the Comparative Fit Index (CFI) and Non-Normed Fit Index (NNFI), which must be over 0.90 [40], the Root Mean Square Error of Approximation (RMSEA) and its 90% confidence interval, and the Standardized Root Mean Square Residual (SRMR), which must be below 0.05 to be considered adequate or between 0.05 and 0.08 to be considered acceptable [41]. The measurement invariance across sex was tested by a multi-group CFA. Model fit was assessed by ΔCFI and ΔNNFI. There is invariance if ΔCFI and ΔNNFI are $< 0.01$ [42]. Internal consistency was found with the ordinal $\alpha$. To find evidence of convergent validity, the Pearson's correlation was found for the BIAQ factors, the total score on the DCQ, the CDI depressive symptoms and the MBSRQ-AS factors. Finally, the ROC curve was found to determine the sensitivity and specificity of the BIAQ questionnaire and to recommend a

cutoff point. All statistical analyses were performed with Factor 10.4.01, SPSS 24 and LISREL 8.7 software.

## Results

### Descriptive analyses of the items on the BIAQ scale

The results of the descriptive analyses of the BIAQ are shown in Table 1. The data did not follow either a univariate or a multivariate normal distribution. The Mardia test showed a statistically significant result = 181.61, $p < .001$. Skewness ranged from 0.01 to 3.22, and kurtosis from 0.02 to 10.43. Item 10 was the only one that exceeded a critical skewness of 3 and kurtosis 10. The percentages of affirmative answer choices—that is, subjects who scored 4 or 5—were found for each of the items. Table 1 shows that Items 2 and 4 had the lowest response frequency. These items refer to the use of clothing the subject dislikes and loose clothing, respectively. The items answered the most frequently were Items 14 and 19 about personal care habits, such as looking at oneself in the mirror, using makeup and dressing well. A comparison of means of the total BIAQ score was performed between the sexes. Statistically significant differences were found, in which girls had a higher mean ($t(4281) = -17.95$, $p < .001$; $M_{girls}$=26.21, SD = 11.29, $M_{boys}$=20.32, SD = 9.81).

**Table 1** Descriptive statistics of the items on the BIAQ

| Items | Mean (SD) | Skewness | Kurtosis | Percentage of affirmative responses |
|---|---|---|---|---|
| 1 | 1.93 (1.46) | 0.28 | −0.87 | 18.5% |
| 2 | 0.53 (0.87) | 2.03 | 4.62 | 1.4% |
| 3 | 2.31 (1.39) | −0.04 | −0.79 | 22.7% |
| 4 | 0.34 (0.92) | 3.22 | 10.43 | 2.7% |
| 5 | 1.12 (1.43) | 1.17 | 0.32 | 8.4% |
| 6 | 1.12 (1.31) | 0.95 | −0.03 | 5.9% |
| 7 | 0.47 (1.12) | 2.69 | 6.53 | 4.6% |
| 8 | 0.68 (2.15) | 2.15 | 3.92 | 5.3% |
| 9 | 0.58 (2.43) | 2.43 | 4.89 | 6.3% |
| 10 | 0.41 (3.15) | 3.15 | 8.99 | 4.9% |
| 11 | 0.46 (1.17) | 2.78 | 6.93 | 5% |
| 12 | 2.07 (0.36) | 0.36 | −0.71 | 16.5% |
| 13 | 1.20 (1.40) | 1.01 | 0.02 | 8.9% |
| 14 | 3.51 (1.56) | −0.80 | −0.47 | 59.1% |
| 15 | 1.54 (1.84) | 0.84 | −0.78 | 20% |
| 16 | 0.79 (1.39) | 1.76 | 1.95 | 8.5% |
| 17 | 0.80 (1.45) | 1.81 | 2.07 | 8.9% |
| 18 | 1.14 (1.64) | 1.19 | 0.04 | 13.1% |
| 19 | 2.57 (1.91) | −0.18 | −1.48 | 40.3% |
| Total BIAQ | 23.61 (11.06) | 1.11 | 2.19 | |

### Preliminary analyses

The sample was divided at random into two groups. The sociodemographic variables (sex, age, and SCI, $p > .05$) and BIAQ overall measurements ($p > .05$) were equivalent in both groups (Table 2).

### Exploratory factor analysis of the BIAQ

The EFA of the BIAQ was done with Sample 1 ($n = 2136$). Robust Diagonally Weighted Least Squares (RDWLS) estimation was performed using the polychoric correlations matrix and direct oblimin rotation. The results were adequate for the KMO = 0.82 [95% CI = 0.81, 0.84] and Bartlett´s test of sphericity, $X^2_{(171)} = 8298.6$, $p < .001$. Schwarz's Bayesian Information Criterion recommended a four-factor solution that explained up to 55% of the variance. The factors and distribution of items were identical to those found by Rosen et al. [23]; although Item 18 loaded onto two factors with similarly, it was considered more appropriate for the "Clothing" factor, as proposed by the authors (Table 3). The correlations between factors were statistically significant ($p < .05$) and ranged from 0.385 to 0.090.

### Confirmatory factor analysis of the BIAQ

CFA was performed with sample 2 ($n = 2146$) using RDWLS estimation with an asymptotic covariance matrix. Four models were tested (Table 4): the four-factor model extracted from the EFA (Model 1); a second-order model with one general factor representing the total BIAQ score and the four

**Table 2** Comparison of means between sample 1 and sample 2 of sociodemographic variables and total scores on BIAQ

| | Sample 1 ($n = 2136$) *M* (SD), *n* (%) | Sample 2 ($n = 2146$) *M* (SD), *n* (%) | $t/\chi^2$ (*df*) | *p* |
|---|---|---|---|---|
| Age | 14.68 (1.67) | 14.64 (1.67) | 0.919 (4281) | 0.358 |
| SCI[a] | 43.56 (21.12) | 42.51 (21.53) | 1.62 (4281) | 0.106 |
| BIAQ-total | 23.74 (11.35) | 23.48 (20.76) | 0.772 (4281) | 0.440 |
| Girls % | 1178 (49.20) | 1216 (50.80) | 0.961 (1) | 0.327 |

[a] *SCI* social class index

**Table 3** Exploratory factor analysis rotated factor matrix loadings with sample 1 ($n=2136$)

| Items | Social activities | Grooming and weighing | Clothing | Eating restraint |
|---|---|---|---|---|
| BIAQ 10 | **1.09** | | | |
| BIAQ 11 | **0.867** | | | |
| BIAQ 9 | **0.858** | | | |
| BIAQ 8 | **0.691** | | | |
| BIAQ 18 | 0.319 | | **0.296** | |
| BIAQ 19 | | **0.706** | | |
| BIAQ 14 | | **0.626** | | |
| BIAQ 12 | | **0.267** | | |
| BIAQ 1 | | | **0.849** | |
| BIAQ 16 | | | **0.795** | |
| BIAQ 4 | | | **0.710** | |
| BIAQ 3 | | | **0.638** | |
| BIAQ 2 | | | **0.497** | |
| BIAQ 13 | | | **0.438** | |
| BIAQ 17 | | | **0.339** | |
| BIAQ 15 | | | **0.279** | |
| BIAQ 5 | | | | **0.703** |
| BIAQ 6 | | | | **0.661** |
| BIAQ 7 | | | | **0.364** |
| % Explained variance | 28.95% | 10.35% | 8.95% | 6.77% |

first-order factors found in the EFA (Model 2); a reduced, 14-item model with two factors (exposure and social discomfort; Model 3), as proposed by Lydecker et al. [31]; and a model (also reduced, to 13 items) as proposed by Campana et al. [29], with three factors (body shape, refusal strategies, body exposure and accommodation strategies; Model 4). All the models showed very similar (adequate) goodness-of-fit indicators. However, Model 4 had four items with factor loadings below 0.30 and was the one with the most residuals. The factor loadings in the rest of the models were over 0.30. Keeping in mind that the goodness-of-fit indicators were good in the models in which no items were eliminated, Model 2 was chosen because it includes the possibility of obtaining a total score on the BIAQ scale, which may be used as a criterion of severity of altered behaviour related to body image. Figure 1 shows the completely standardized factor loadings.

## Measurement invariance across sex

A CFA performed on the unconstrained measurement model with the complete sample ($n=4283$) analysed boys and girls separately and found adequate goodness-of-fit indicators. Next, a multiple-group CFA was performed wherein the baseline model was estimated (M0, configural invariance) by constraining the factor structure, but freely estimated the loading factor and thresholds between sexes. Some of the goodness-of-fit indicators for this model were appropriate. Then, the factor loadings and the thresholds were constrained to be equal across sex (M1, scalar invariance). Comparing the goodness-of-fit indicators found with the M0, the increase in CFI and NNFI was $<0.01$. Therefore, these results show evidence that the structure of the BIAQ (latent construct and items loading on each construct), the factor loadings and the thresholds are invariant across sex (see Table 5).

## Reliability and validity evidence

The internal consistencies of the total BIAQ and the four factors were assessed. An ordinal $\alpha=0.91$ was found for the total BIAQ. The "clothing" factor had an $\alpha=0.76$, the "social activities" factor an $\alpha=0.91$, the ordinal $\alpha$ of the "eating restraint" factor was $\alpha=0.65$ and for the "grooming and weighing" factor, an $\alpha=0.56$ was found.

Pearson's correlation coefficient was calculated to study the evidence for convergent validity (Table 6). All the correlations were statistically significant except the correlations between "social activities" and "appearance evaluation", and between "clothing" and "overweight preoccupation". The relationships of the total BIAQ with dysmorphic concerns, appearance orientation, overweight preoccupation and depressive symptoms were positive, and correlations with body area satisfaction (BAS) and appearance evaluation (AE) were negative, showing that the participants who evaluated different areas of their body (BAS) and general appearance (AE) worst had the highest scores on the total BIAQ. The correlations were especially strong between the BIAQ "Grooming and Weighing" and "appearance orientation"

**Table 4** Model fit indices for the models with Sample 2 ($n=2146$)

| Models | Satorra–Bentler Scaled Chi$^2$ | *df* | CFI | RMSEA 90% CI | NNFI | SRMR |
|---|---|---|---|---|---|---|
| Model 1 | 912.75 | 146 | 0.970 | 0.050 [0.046, 0.053] | 0.962 | 0.068 |
| Model 2 | 937.143 | 148 | 0.970 | 0.050 [0.047, 0.053] | 0.962 | 0.069 |
| Model 3 | 481.280 | 76 | 0.977 | 0.050 [0.046, 0.054] | 0.972 | 0.060 |
| Model 4 | 559.973 | 62 | 0.962 | 0.061 [0.057, 0.066] | 0.952 | 0.083 |

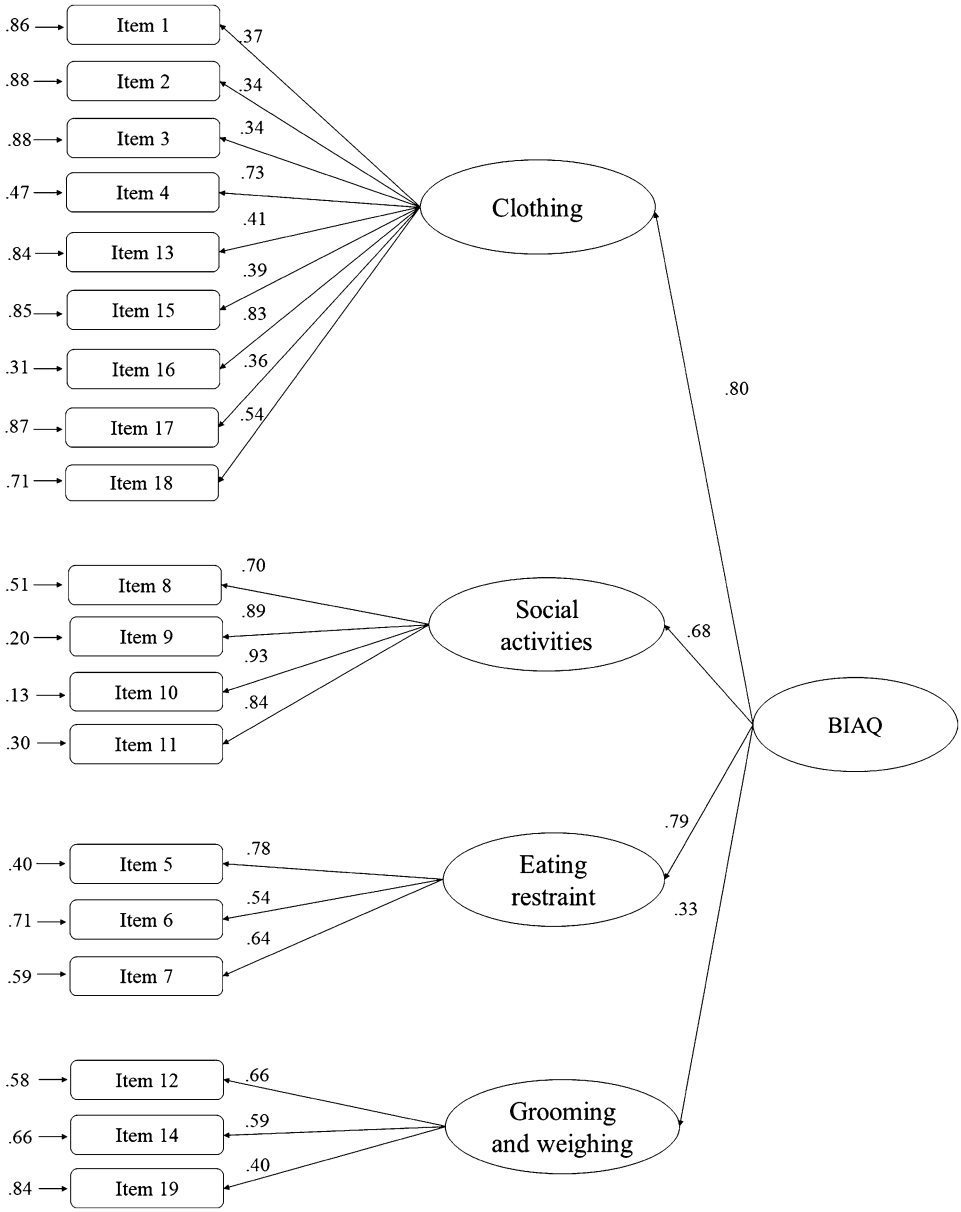


**Fig. 1** Path diagram and estimates for the first-order factors related to a second-order of the BIAQ with sample 2

**Table 5** Model fit indices for measurement invariance across sex

| Models | Satorra–Bentler Scaled Chi$^2$ | *df* | CFI | RMSEA 90% CI | NNFI | SRMR | ΔCFI | ΔNNFI |
|---|---|---|---|---|---|---|---|---|
| Boys | 659.81 | 148 | 0.969 | 0.043 [0.039, 0.046] | 0.973 | 0.062 | | |
| Girls | 1139.67 | 148 | 0.968 | 0.053 [0.050, 0.056] | 0.963 | 0.072 | | |
| M0. Configural | 1745.41 | 297 | 0.967 | 0.048 [0.046, 0.049] | 0.962 | 0.071 | | |
| M1. Scalar | 1925.13 | 312 | 0.963 | 0.049 [0.047, 0.051] | 0.960 | 0.076 | −0.004 | −0.002 |

factors and between the "eating restraint" and "overweight preoccupation" factors.

To find the sensitivity and specificity of the BIAQ, two groups of participants were formed: one group made up of those who scored above the 85th percentile on the DCQ and CDI (considered at risk of body image disturbance, $n = 276$) and the other of those who scored below the 85th percentile on either of the two measures (no risk, $n = 3367$). The ROC area under the curve was statistically significant (area = 0.84, $p < .001$, 95% CI [0.817, 0.869]), showing 74% sensitivity

**Table 6** Bivariate correlations between BIAQ, DCQ, MBSRQ-AS factors and CDI

| | DCQ | MBSRQ-AO | MBSRQ-AE | MBSRQ-OP | MBSRQ-BAS | CDI |
|---|---|---|---|---|---|---|
| BIAQ- Total | 0.540** | 0.379** | −0.338** | 0.542** | −0.294** | 0.466** |
| BIAQ- Clothing | 0.483** | 0.052* | −0.380** | 0.341** | −0.303** | 0.477** |
| BIAQ- social activity | 0.274** | 0.123** | −0.043 | 0.178** | −0.096** | 0.250** |
| BIAQ- eating restraint | 0.302** | 0.293** | −0.306** | 0.602** | −0.219** | 0.207** |
| BIAQ- grooming and weighing | 0.271** | 0.673** | −0.129* | 0.402** | −0.118** | 0.151** |

*MBSRQ-AO* appearance orientation, *MBSRQ-AE* appearance evaluation, *MBSRQ-OP* overweight preoccupation, *MBSRQ-BAS* body areas satisfaction

**$p < .01$. *$p < .05$

and 80% specificity for a cutoff point of 29.5 points. This cutoff point corresponds to the 75th percentile (29 points). Considering these results, 24.06% of the sample were at risk of body image disturbance, 72.7% of whom were girls. If this at-risk cutoff point were to be raised to the 85th percentile, 16.20% of the sample with scores equal to or higher than 34 points would be identified.

## Discussion

The main objective of this study was to validate the translated version of the BIAQ in an adolescent Spanish population, to examine its factor structure and invariance across sex and to find its psychometric properties. In agreement with the authors of the BIAQ [23], as well as Maïano et al. [28] and Steinfeld et al. [27], the instrument showed evidence of construct validity. Four first-order factors and one higher-order factor, which included the total BIAQ score, were found. In the CFA, all the items saturated on their corresponding factor with loadings over 0.32 [43], and there were no cross-loadings; thus, it was not considered necessary to eliminate any items as other studies have done [29, 31].

The BIAQ mean for the whole sample coincided with that found by Maïano et al. [28] for French adolescents and that found by Lydecker et al. [31] for white female university students. The analyses of invariance across sex showed that the BIAQ's structure is comparable between boys and girls and that the scores can, therefore, be interpreted the same way across sex.

The results show that the BIAQ is a valid and reliable instrument for detecting altered adolescent body image behaviour, although with some nuances. The internal consistency of the total scale was adequate, as well as for the "social activities" and "clothing" factors. However, for the subscales "eating restraint" and "grooming and weighing", internal consistency was rather low. These results are similar to those found by Brytek-Matera and Rogoza [30], who found low internal consistency in both the clinical and control groups for a factor grouping "eating restraint" with "weighing and grooming". In the German validation with adolescents [27], the "grooming and weighing" factor also had inappropriate internal consistency. However, in the French validation, internal consistency was found to be acceptable for this factor, although with a small sample size ($n = 106$ subjects). Lydecker et al. [31] eliminated five of the six items corresponding to the "eating restraint" and grooming and weighing" scales and found a two-factor model, whose goodness-of-fit indicators were better than those reported for the original scale in our study (Model 3), as well as in their own and in the recent study by Pellizzer et al. [44]. However, Lydecker et al. [31] did not report what criteria were used to decide on eliminating those items, which could be methodologically questionable. Furthermore, in an additional analysis with the sample in this study (not published in this manuscript for reasons of space), the internal consistency of the reduced questionnaire proposed by Lydecker et al. [31] was identical to the complete questionnaire, and therefore, the elimination of these items was not justified. These problems with the internal consistency of the "eating restraint" and "grooming and weighing" subscales may be due to their only consisting of three items, or due to the construction of the items on these subscales actually differing from the items on the "social activities" and "clothing" subscales: the first two more closely approximate a checking or behaviour control component ("I restrict the amount of food I eat", "I weigh myself"), whereas the latter seems more related to an avoidance component ("I do not go out socially if I will be 'checked out'", "I avoid physical intimacy"). The "weigh myself "or "look at myself in the mirror" components, when highly frequent, may become compulsive in patients with eating disorders (EDs) but may also be avoided. In fact, Shafran et al. [10] found that both behaviours alternately appear in EDs depending on changes in mood, eating or weight. Therefore, responses to these items may be inconsistent in a person with body image disturbance. Furthermore, if it is a question of evaluating avoidance behaviours, why are the items on the "grooming and weighing" subscale not scored inversely? If it is a matter of having a measure of severity of behavioural impairment,

perhaps it would be of interest to consider the sum of direct scores as such, as conceived by Rosen et al. [23], but if a measure evaluating avoidance behaviour is sought, in our opinion, it would be necessary to invert the items on this subscale.

Because the evidence for the "eating restraint" and "grooming and weighing" factors is not very clear, we think it may be more recommended to consider the BIAQ as a whole—that is, taking the total score on this instrument as an overall measure to assess severity of behavioural impairment related to body image (at least in subjects not diagnosed with body image disorder). Future studies of patients with body image disorder (BID) may shed light on how to interpret the "Grooming and Weighing" subscale items.

Evidence of the convergent validity of the BIAQ has often been analysed by comparison with measures assessing EDs symptoms (e.g., [27, 28, 30, 44]). However, none of the known validations has compared it to a test nearer to another aspect of preoccupation with appearance: dysmorphic symptoms or concerns. The results of this study found a strong relationship between dysmorphic concerns and the total BIAQ score, as well as the "clothing" factor; moderate–low correlations were found with "social activities", "eating restraint" and "grooming and weighing". This result could suggest that dysmorphic concerns and altered behaviour are overall indicators of impairment or alteration related to body image, although for precision, it relies on the individual factors. Moreover, a strong relationship was found between the total BIAQ score and the "overweight preoccupation" factor, but moderate with the inversion performed in trying to improve appearance (appearance orientation) and dissatisfaction with appearance, as evaluated with "appearance evaluation" and "body areas satisfaction". The relationship between the BIAQ with depressive symptomatology was in very strong agreement with other studies [27, 44, 45].

This study had some limitations that have to be taken into consideration. It was a cross-sectional study with a single measure, in which the stability of the measurement could not be analysed to find test–retest reliability. The data collected correspond to adolescents in the community who were not diagnosed with BID, which means that to find a cutoff point on the BIAQ, it was necessary to characterize participants with scores above the 85th percentile in dysmorphic concerns and depressive symptoms as meeting criteria for risk of BID. Therefore, the cutoff point of 29.5 points on the BIAQ should be taken as an approximate measure or criterion warning of behavioural impairment related to body image, and future studies working with clinical samples should contribute more precise data on the questionnaire's cutoff point.

In spite of its limitations, this study has some strengths. The BIAQ was validated with a large sample of adolescents of both sexes. Furthermore, the participants were adolescents within a wide age range from different urban and rural settings. Evidence of convergent validity with measures related to investment in and dissatisfaction with physical appearance both related to symptoms closer to EDs but also to BDD.

In conclusion, the BIAQ is considered a brief, valid and reliable measure for assessing the behavioural component of body image in boys and girls that has to do not only with avoidance but also with checking and controlling physical appearance. The high percentage of the sample at risk of body image disturbance behaviour emphasizes the importance of having an instrument with psychometric properties that can ensure its use as a screening scale for assessing maladaptive behavioural expression reflecting negative body image. To identify and intervene in body image checking and avoidance behaviours, it is crucial to stop feedback from cognitive distortions related to weight, shape and physical appearance, which maintain the symptomatology of BID in a period of such maximum vulnerability as adolescence. Furthermore, the BIAQ is a tool that can enable a certain type of modifiable behaviour to be delimited in intervention and even be applied as a criterion of therapeutic progress.

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## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** The Andalusia (Spain) Bioethics Committee approved the study. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed consent** An information sheet with the objectives of the study and an informed consent form were provided for parents or guardians to give their authorization for their children to participate in the study.

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